

THE FAMILIES TRACHIPTERIDAE AND RADIICEPHALIDAE (PISCES, LAMPRIFORMES) AND A NEW SPECIES OF *ZU* FROM SOUTH AFRICA

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(With 11 figures and 2 tables)

[MS accepted 26 October 1983]

ABSTRACT

The trachipterid fishes of South Africa comprise five species: *Trachipterus trachipterus* (Gmelin, 1789), *T. jacksonensis* (Ramsay, 1881), *Desmodema polystictum* (Ogilby, 1897), *Zu cristatus* (Bonelli, 1820), and a new species *Zu elongatus*. *T. nigrifrons* Smith, 1956, is considered a synonym of *T. jacksonensis*, and *T. woodi* Smith, 1953, appears to be a synonym of *D. polystictum*. *Zu elongatus* sp. nov. is described from four specimens (including two adults) from off the western Cape Province. It differs from *Zu cristatus* in body depth, size of eye, number of lateral-line scales and vertebral counts. *Zu elongatus* probably also occurs in New Zealand. The rare adult stage of *Zu cristatus* is described from a specimen captured off Kenya. Observations on a juvenile specimen of *Zu* swimming in the ocean are reported for the first time. A juvenile specimen of *Radiicephalus elongatus* Osório, 1917 (the first South African record for this species) is also described.

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INTRODUCTION

As part of the research being done for a forthcoming revision of J. L. B. Smith's (1953) book *The sea fishes of southern Africa*, the trachipterid fishes of the J. L. B. Smith Institute were examined. In comparing specimens at the South

African Museum with the meagre data from the material in the Smith Institute, the second author (S. X. K.) discovered a new species of the genus *Zu*. The first South African record of the related family Radiicephalidae is based on a juvenile specimen recently collected in an Engels trawl 70 miles south-west of Cape Point.

METHODS

All measurements are from point to point, and those from the front of the snout were taken from the premaxillary symphysis with the upper jaw retracted. Standard length (SL) is measured from the front of the snout to the base of the upper caudal fin rays. Snout to vent distance (SV) is from the front of the snout to the anus. Head length is from the front of the snout to the posterior margin of the gill cavity. Snout length is from the front of the snout to the anterior margin of the orbit. Lower jaw length is from the anterior tip of that jaw to the posterior end of the articular bone. Maxilla width is the greatest width of the maxilla. The anteriormost vertebra with a haemal spine is considered the first caudal vertebra. Body depth is the greatest depth of the body. Pre-anal vertebrae are those anterior to a vertical line through the anus. Vertebral counts were made from radiographs or from cleared and stained material. Lateral-line counts begin with the scale just above the opercle and stop at the end of the vertebral column.

In the lists of material examined, abbreviations are as follows:

BMNH British Museum (Natural History)
NMNZ National Museum of New Zealand
RUSI J. L. B. Smith Institute of Ichthyology
SAM South African Museum
SIO Scripps Institute of Oceanography
USNM US National Museum of Natural History

Family Trachipteridae

Diagnosis

Body elongate, more or less compressed. Dorsal fin origin above or slightly behind eye; lateral edges of dorsal fin rays with minute spines or prickles (conspicuous in prejuveniles but less obvious in adults). Ventral rays of caudal fin reduced (rudimentary or absent in some species); pelvic fins rudimentary or absent in adults; in prejuveniles the pelvic fin rays are elongate and the first ray bears a row of prickles; anal fin absent. Upper jaw highly protrusile. Posterior vertebrae of adults elongate, two to four times longer than tenth vertebra; ribs absent. Ink sac absent; swim-bladder rudimentary. Skin of adults with bony or cartilaginous tubercles and pierced by numerous pores; lateral line with cartilaginous or bony plates.

Remarks

The monotypic family Radiicephalidae was redefined by Harrison & Palmer (1968); the remaining families and genera of the suborder Trachipteroidei have

been reviewed by Walters & Fitch (1960). The trachipterid species of the north-east Atlantic and Mediterranean were revised by Palmer (1961), and those of the eastern Pacific were treated by Fitch (1964).

Like the related oar-fish (family Regalecidae), the trachipterids are members of the off-shore epipelagic community (Parin 1968). They have been observed swimming in a head-up position by means of undulations of the dorsal fin (Nishimura & Hirosaka 1964). The peculiar skin tubercles and pore system are thought to reduce drag when the fish is swimming (Walters 1963). Three genera are recognized. Although more than thirty species have been described, there are probably fewer than ten valid species in this family.

KEY TO GENERA OF FAMILY TRACHIPTERIDAE

- 1a Caudal fin comprises 4–10 dorsal rays approximately parallel to the long axis of the body; ventral caudal rays absent; no elongate spiny plates or bony tubercles along ventral edge of tail *Desmodema*
- 1b Caudal fin of two parts: 6–12 dorsal rays usually set at a steep angle to the long axis of the body and 1–5 ventral rays (rudimentary spiny nubbins in *Trachipterus* and adult specimens of *Zu*); elongate spiny plates or bony tubercles along ventral edge of tail 2
- 2a Lateral line runs along ventral edge of tail as a zigzag series of elongate spiny plates; subadults (less than 700 mm SL) with ventral edge of body distinctly scalloped; body depth 1.5–2.9 in SV *Zu*
- 2b Lateral line straight, well above ventral edge of tail in adults (specimens more than 1 500 mm SL); ventral edge of tail in adults with bony tubercles but no elongate spiny plates; ventral edge of body straight; body depth 3.7–4.1 in SV *Trachipterus*

Genus *Desmodema* Walters & Fitch, 1960

Diagnosis

Seven dorsal pterygiophores before first neural spine; no predorsal bones; caudal fin on same horizontal axis as caudal peduncle, comprising 4–10 dorsal rays; ventral caudal rays absent; tail greatly elongated in juveniles and adults; ventral body profile of prejuveniles (specimens less than 100 mm SV) not scalloped. Prejuveniles silvery, with numerous round dark spots.

Remarks

This genus was recently revised by Rosenblatt & Butler (1977). They recognize two species. *D. lorum* Rosenblatt & Butler, 1977, is known only from the North Pacific.

Desmodema polystictum (Ogilby, 1897)

Fig. 1A

Trachipterus jacksoniensis polystictus Ogilby, 1897: 649.

Trachipterus sp.: Smith, 1949: 504, fig. 264b.

Trachipterus woodi Smith, 1953: 504, fig. 264b; 1966: 83, pl. 15 (fig. A).

Trachipterus woodi: King & Ikehara, 1956: 22, fig. 5.

Desmodema polystictum: Rosenblatt & Butler, 1977: 848, figs 1–4.

(See Rosenblatt & Butler (1977) for additional synonyms and references.)

Material

Holotype of *T. woodi* Smith, RUSI 133, SV 89 mm (rear end of tail missing); Xora River mouth, Transkei.

SIO 75-139, SL 100 mm, SV 72 mm; 10°00'N 119°00'W; midwater trawl; 0-50 m.

SAM-27786, SL 96 mm, SV 68 mm; found in a tidal pool at Simon's Town, False Bay, Cape Peninsula.

USNM 164171, SL 113 mm, SV 78 mm; 04°41'N 159°53'W (radiograph only seen).

Diagnosis

This diagnosis is according to Rosenblatt & Butler 1977, plus data from specimens mentioned above.

Dorsal fin rays 120-128; pectoral fin rays 12-14; caudal fin rays 7-10; gill-rakers 2-3+9-10. Vertebrae: 71-74 total, 18-20 precaudal, 37-42 pre-anal. Eye diameter greater than snout length. Tail greatly elongated in adults; SV about two-thirds SL in prejuveniles and one-third SL in adults.

Remarks

Smith (1966) gave an amended, amplified description of the holotype of *T. woodi*. The following data not supplied by Smith are added here. SV 89 mm, body depth at pelvic fin origin 33 mm, head length 24 mm, eye diameter 10,1 mm, snout length 7,0 mm, maxilla width 6,0 mm, lower jaw length 10,6 mm. All the pelvic fin rays have been broken off at the base, but there seem to be 7 nubbins on the left side and 8 on the right. Because of the poorly ossified bones of this small specimen (perhaps made worse by preservation in formalin), it is difficult to get a clear radiograph. The anterior dorsal fin pterygiophores in relation to the first neural spine and the transition from precaudal to caudal vertebrae cannot be discerned, but the number of pre-anal vertebrae is clearly 41.

Data from the SAM specimen are as follows: SL 96 mm; SV 68 mm; dorsal fin rays 128, first five rays elongate, the longest is 37 % SL; pectoral rays 13; pelvic rays 9, elongate, reaching caudal fin; caudal rays 8; gill-rakers 3+9; lateral-line scales 158, each plate with a single spine except fifteenth, which has a double spine; anus asymmetrical, on left side 1,5 mm above ventral edge of body. Vertebrae: precaudal 20, pre-anal 37, total 74.

Comparison of the holotype of *T. woodi* with one of the prejuvenile specimens of *D. polystictum* examined by Rosenblatt & Butler (1977) revealed no significant differences between these two specimens. *T. woodi* is therefore considered a synonym of *D. polystictum*. The possibility of *T. woodi* being a synonym of *D. polystictum* and the record of *T. woodi* from the Pacific (King & Ikehara 1956) were apparently overlooked by Rosenblatt & Butler (1977).

Distribution

South Africa, Australia, Japan, eastern Pacific and western Atlantic.

Genus *Trachipterus* Goüan, 1770*Diagnosis*

Body depth of adults 3.7–4.4 in SV, not greatly constricted behind vent. Ventral edge of body straight, with enlarged pointed tubercles. Lateral-line plates of adults more or less fused to form an almost continuous tube with rudimentary blunt spines; prejuveniles and juveniles with separate, oval lateral-line plates, each with a central, well-defined spine. In adults the lateral line runs well above the ventral edge of the tail, but in smaller specimens the lateral line runs fairly close to the ventral edge of the tail along the rear half of the tail. Dorsal and pelvic fin rays of prejuvenile stage without series of bulbous or leaf-like appendages; first five or six dorsal rays, pelvic and caudal rays elongate in prejuveniles and juveniles. Dorsal caudal rays well developed, set at steep angle to horizontal axis of peduncle. One pterygiophore before first neural spine, and 8 or 9 between first and second neural spines. Scales absent.

KEY TO SOUTH AFRICAN SPECIES OF *TRACHTERUS*

- 1a Pectoral fin rays 8–11; eye diameter 1.4–1.6 in lower jaw length; tubercles small and indistinct except along ventral edge of body and tail, not arranged in rows along each side of dorsal fin pterygiophores *T. trachipterus*
 1b Pectoral fin rays 13 or 14; eye 1.9–2.2 in lower jaw length; tubercles distinct, those along ventral edge of body and tail larger, pointed and slightly curved; tubercles arranged in rows along each side of dorsal fin pterygiophores *T. jacksonensis*

Trachipterus jacksonensis (Ramsay, 1881)

Figs 2–3

Regalaecus jacksonensis Ramsay, 1881: 631, pl. 20.*Trachipterus jacksonensis*: McCulloch, in Whitley, 1927: 296, pl. 25 (fig. 2).*Trachipterus nigrifrons* Smith, 1956: 449, text fig. and pl. 12; 1965: 18.*Material*

Holotype of *Regalaecus jacksonensis* Ramsay, Australian Museum A9114 (radiograph only).

Holotype of *T. nigrifrons* Smith, RUSI 52, 1 210 mm total length (*vide* Smith 1956), East London.

RUSI 13128, 1 320+ mm total length; East London.

SAM-25093, 2 110 mm SL, 1 050 mm SV; trawled west of Cape Town.

SAM-26731, 1 220+ mm SL, 600 mm SV; trawled west of Cape Peninsula.

SAM-28380, 1 490 mm SL, 700 mm SV; trawled 34°31'S 17°59'E.

Diagnosis

Dorsal fin rays 166–173, the first 6 rays short and hairlike; pectoral fin rays 13 or 14; gill-rakers 3–5 + 8. Vertebrae: 81–83 total, 31–34 precaudal, 44–48 pre-anal. Eye diameter 1.9–2.2 in lower jaw length, 6.0–7.3% SV. Dermal tubercles on body distinct, those along ventral margin of body and tail enlarged, pointed and slightly curved; tubercles in rows along each side of dorsal fin pterygiophores

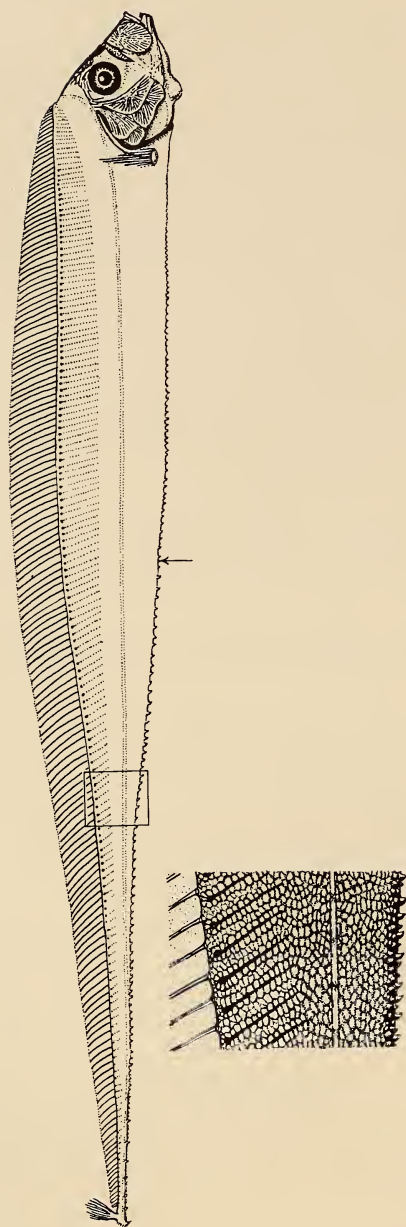


Fig. 2. *Trachipterus jacksonensis* (Ramsay, 1881). Drawn from holotype of *T. nigrifrons* Smith, RUSI 52, 1 210 mm TL. Pectoral fin reconstructed. Arrow indicates position of anus; inset shows detail of skin tubercles from middle of tail.

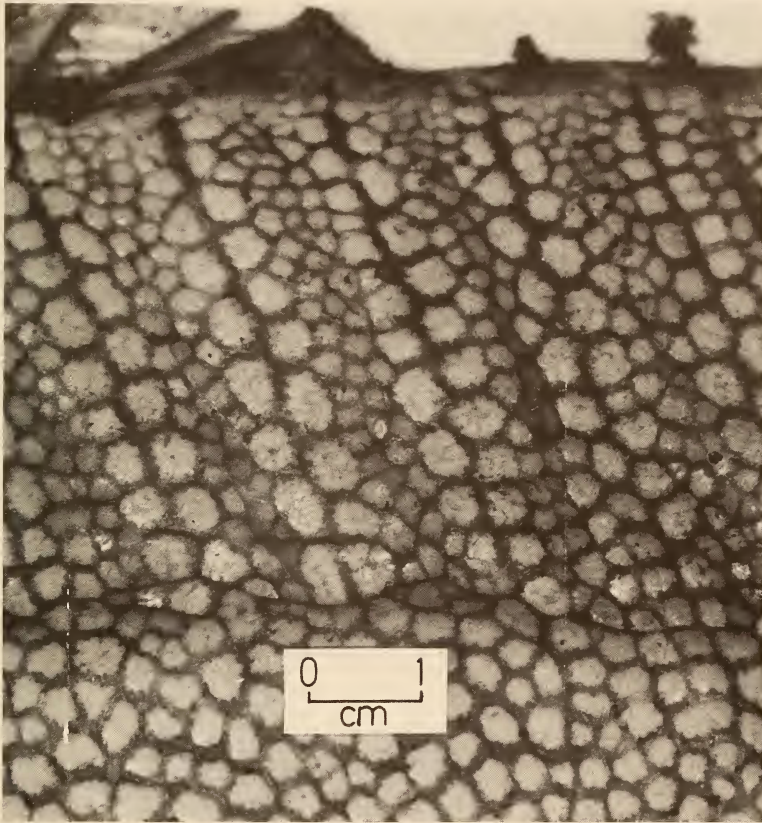


Fig. 3. *Trachipterus jacksonensis* (Ramsay, 1881). Arrangement of tubercles in vertical rows along dorsal fin pterygiophores.

(Fig. 3). Head and body silvery; front of head, interorbital area, dorsal part of upper jaw and tip of lower jaw black.

Remarks

Smith (1956) compared his new species *T. nigrifrons* with two species (*T. ishikawae* and *T. ijimae*) described by Jordan & Snyder (1901) from Japan. *T. ijimae* was synonymized with *Zu cristatus* by Fitch (1964: 231). In comparing *T. nigrifrons* and *T. ishikawae*, Smith (1956) used data from a later paper by Jordan & Snyder (1904), which is based on two non-type specimens that may or may not be conspecific with the holotype of *T. ishikawae*. In the original description of *T. ishikawae* the numbers of pectoral fin rays and gill-rakers are not given, and without having recourse to the holotype the identity of this species must remain in doubt.

Smith (1956) apparently overlooked the detailed description of *T. jacksonensis* (Ramsay, 1881) given by McCulloch (in Whitley 1927). McCulloch's

description agrees with Smith's (1956) account of *T. nigrifrons*, and McCulloch, after comparing his specimen with the holotype of *T. jacksonensis*, stated that (p. 297) 'it appears a little deeper than the holotype, to which it is exactly similar in every other detail'.

Distribution

South Africa and Australia.

Trachipterus trachipterus (Gmelin, 1789)

Fig. 4

Cepola trachiptera Gmelin, 1789: 1187.

Trachipterus arawatae Clarke, 1881: 195, text-fig.

Trachipterus jacksonensis (non Ramsay): Hamilton, 1916: 372, fig. 1.

Trachipterus arcticus (non Brünnich): Barnard 1925: 353.; pl. 14 (fig. 3); 1948: 359, fig. 17.

Trachipterus iris: Smith, 1949: 141, fig. 264.

Trachipterus trachipterus: Hamilton, 1916: 374, figs 3–6. Palmer, 1961: 342, pl. 62 (fig. 2).

(See Palmer (1973) for additional synonyms and references.)

Material

BMNH 1891.8.31.27–35, 7 specimens, North Atlantic (radiograph only seen).

RUSI 13106, 1 620+ mm SL, 710 mm SV; South Africa, no data.

SAM-11894, 540+ mm SL, 236 mm SV; South Africa, no data.

SAM-22078, 1 860 mm SL, 900 mm SV; trawled off Dassen Island (33°25'S 18°E).

SAM-23677, 113 mm SL, 82 mm SV; trawled off Slangkop, Cape Peninsula.

SAM-24024, c. 520 mm SL (damaged), 250 mm SV; trawled west of Cape Town.

SAM-26708, 55 mm SL, 40 mm SV; 33°06'S 16°08'E; 150–0 m; N100B plankton net.

Diagnosis

Dorsal fin rays 145–184, first 5 or 6 rays elongate in juveniles and prejuveniles, forming a dorsal pennant; pectoral rays 9–11; gill-rakers 3–5 + 10. Vertebrae: 84–96 total, 35–39 precaudal, 49–57 pre-anal. (Vertebral counts for the New Zealand specimen NMNZ 2056 are c. 97 total and about 42 precaudal.) Eye diameter (of adults) 1.4–1.6 in lower jaw length, 8.4–8.9% SV. Dermal tubercles on body small, except along ventral margin of body and tail, uniformly distributed over dorsal fin pterygiophores (Fig. 4). Head and body silvery; juveniles with 3–5 dark blotches on body.

Remarks

The present specimens generally agree with Palmer's (1961) account of *T. trachipterus* (Gmelin, 1789), except that they do not have the body axis curved dorsally in the posterior caudal region, and the 540 mm SL specimen

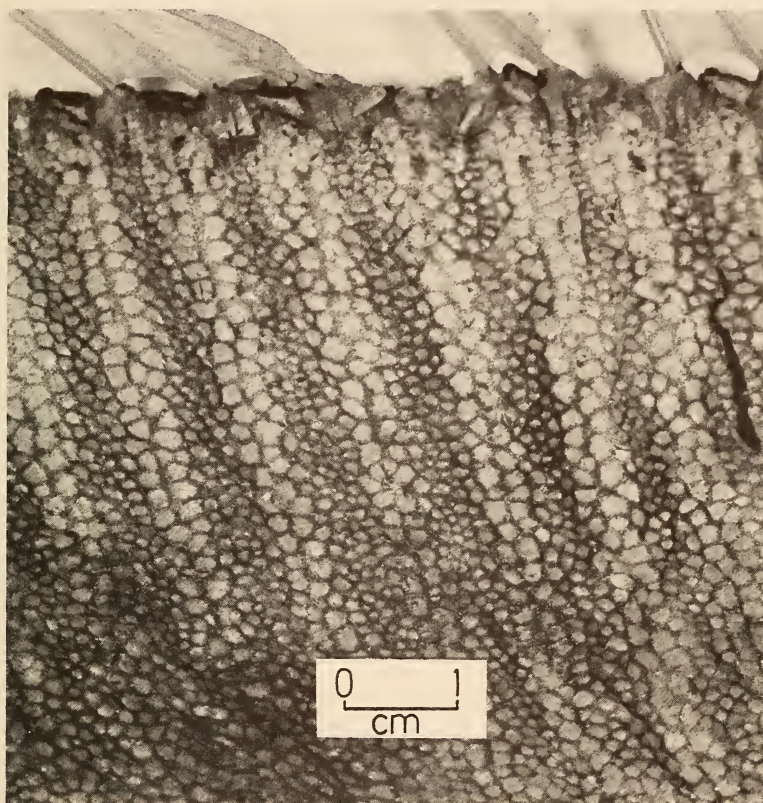


Fig. 4. *Trachipterus trachipterus* (Gmelin, 1789). Uniform arrangement of tubercles along dorsal fin pterygiophores.

(SAM-11894) seems to have the greatest body depth nearer the anus than the head, instead of just behind the head. According to Palmer (1961) *T. trachipterus* differs from *T. arcticus* in the dorsally curved tail and in having the greatest body depth immediately behind the head; in *T. arcticus*, the tail is straight and the greatest body depth is ' $\frac{1}{4}$ to $\frac{1}{3}$ of the way along its length, except in specimens of less than 300 mm'.

The original description of *Cepola trachiptera* Gmelin, 1789, is inadequate to distinguish which species Gmelin was trying to describe: '*C. capite declivi, maxilla utraque fornicata, pinnis aculeatis serratis scabris. Habitat in mari adriatico, linea laterali recta, squamarum serie simplici; an secundum Forsterum proprium genus?*' (*Cepola* with downward-sloping head [i.e. steep forehead], maxilla arched on either side, fins rough [with] saw-like prickles. Habitat in Adriatic Sea, lateral line straight, scales in a single row; according to Forster it may belong in a genus of its own.)

C. trachiptera was the third species of *Cepola* listed by Gmelin (1789: 1186–1187); the first two (*C. taenia* and *C. rubescens*) are considered synonyms of

C. macrophthalma (Linnaeus, 1758). By his placement of *trachyptera* in Linnaeus's genus *Cepola*, Gmelin probably recognized at least a superficial similarity between his new species and *C. macrophthalma*. Hence it seems reasonable to suppose that *C. trachyptera* was an elongate fish with a markedly compressed body and a dorsal fin that ran the length of the body. The steep forehead rules out trichiurids.

Except for trachipterids, the only Adriatic fishes with an elongate compressed body, steep forehead, and long dorsal fin are the oarfish *Regalecus glesne* Ascanius, 1772, and *Lophotus lacepedei* Giorna, 1809. The statement about the fins '*pinnis aculeatis serratis scabris*' apparently refers to the row of minute spines or prickles along the lateral edges of the dorsal fin rays of trachipterid fishes. The species name *trachyptera* means 'rough fin', being derived from the Greek words *trachys* (= rough) and *pteron* (= wing or fin). These fin-ray prickles are lacking in the oarfishes but very conspicuous in juvenile trachipterids.

We are left, then, with *Trachipterus trachipterus* (*sensu* Palmer 1961) and *Zu cristatus* as the Adriatic species that best fit the description given by Gmelin. Because of its greater body depth (which would render the '*Cepola*' designation less likely) and the distinctive features of the prejuveniles (which are unlikely not to be noticed and mentioned in a description), *Zu cristatus* seems the less plausible of the two species. Furthermore, *T. trachipterus* is fairly common in the Adriatic Sea (Jardas 1980).

By a process of elimination together with a few assumptions, we have come to the conclusion that *Cepola trachyptera* Gmelin is the species currently recognized as *Trachipterus trachipterus*.

Hamilton (1916) published descriptions of seven specimens of trachipterids from New Zealand. The specimen from Nelson, South Island, that he illustrated (fig. 2) from his original sketch was doubtfully assigned to *T. jacksonensis*. This specimen, later illustrated by Whitley (1968: 46, fig. 1) under the name '*Desmodema arawatae*', appears to be *Zu elongatus* sp. nov. Judging from the count of eleven pectoral fin rays given for five of the specimens, Hamilton's other specimens appear to be *T. trachipterus*. Hamilton identified his largest, 'approximately 6 ft' specimen with *T. jacksonensis* because it had smooth dorsal fin rays, instead of 'all rays spinous, and having a spiny tubercle at the base' for his juvenile specimens of *T. trachipterus*. Hamilton assumed that the minute spinules or granulations on the dorsal fin rays of juveniles were a good specific character, and were not lost or greatly reduced with growth. However, this is precisely what happens with all trachipterids. In our adult specimens of *Trachipterus* and *Zu* the spinules are absent or very much reduced, compared with those of juveniles.

Distribution

Mediterranean Sea, eastern Atlantic to South Africa, Japan and New Zealand.

Genus *Zu* Walters & Fitch, 1960*Diagnosis*

Young with pelvic and anterior 6 dorsal fin rays greatly elongated, bearing serially arranged, membranous flaps (Figs 1D, 8). One pterygiophore before first neural spine, and 8 or 9 between first and second neural spines. Scales present, though very deciduous, and not apparent in prejuveniles. Body depth 1,7–2,8 in SV, more or less constricted behind anus. Ventral edge of body distinctly scalloped in specimens less than 700 mm SL; belly of specimens more than 800 mm SL nearly straight, but with a low fleshy keel from pelvic fin rudiments to anus. Lateral line drops to ventral edge of tail shortly behind anus, from where it runs as a zigzag series of elongate spiny plates to base of caudal fin and is then continued on to the ventral caudal filament (of prejuveniles) as a straight tube. Total vertebrae 63–69 or 84–87.

KEY TO SPECIES OF *ZU*

- 1a Body depth 12–16% SL; prejuveniles with body not abruptly constricted behind vent; eye 9–10% SV; lateral-line plates 126–130 *Z. elongatus* sp. nov.
 1b Body depth 20–26% SL; prejuveniles with body abruptly constricted behind vent; eye 13–16% SV; lateral-line plates 99–106 *Z. cristatus*

Zu cristatus (Bonelli, 1820)

Figs 1B–D, 5–8

- Trachypterus cristatus* Bonelli, 1820: 487. Smith, 1949a: 99; 1949b: 142, fig. 264a. Dieuzeide *et al.*, 1954: 151, figs. Tortonese, 1958: 1. Parin *et al.*, 1978: 176.
Gymnetrus repandus Metaxà, 1833: 53, fig. 7.
Trachypterus bonelli Valenciennes, in Cuvier & Valenciennes, 1835: 331.
Gymnetrus müllerianus Risso, 1840: 13, pl. 125.
Trachypterus repandus: Costa, 1842: 11, pl.
Trachypterus semiophorus Bleeker, 1868: 279, pl. XII. Weber & de Beaufort, 1929: 89.
Trachypterus iris (non Walbaum): de Buen, 1917: 23, fig.
Trachypterus gavardi Bounhiol, in Bounhiol & Gavard, 1923: 1.
Trachypterus ijimae Jordan & Snyder, 1901: 311, pl. 17 (fig. 9). Tanaka, 1915: 358, pl. 96 (fig. 301). Bolin, 1933: 35. Okada & Suzuki, 1956: 168, fig. 1. Lindberg & Legeza, 1965: 298.
Zu cristatus: Walters & Fitch, 1960: 445. Palmer, 1961: 346. Fitch, 1964: 229, fig. 1. Backus *et al.*, 1965: 139, fig. 2. Ibáñez & Gallego, 1974: 523, fig. 1. Karrer, 1975: 72. Fitch & Schultz, 1978: 89, fig. 5. Parin *et al.*, 1978: 176. Oliver, 1982: 60, figs 1–2.
 (See Palmer (1973) for additional references.)

Material

RUSI 7185, 2 specimens: 64 mm SL, 31 mm SV; 204 mm SL, 90 mm SV; South Africa, no data.

RUSI 7187, 232 mm SL, 106 mm SV; Algoa Bay, eastern Cape Province.

RUSI 7188, 173 mm SL, 77 mm SV; Kariega River mouth, 33°36'S 26°42'E.

RUSI 13352, 950 mm SL, 450 mm SV; off Mombasa, Kenya.

SAM-24522, 415 mm SL, 170 mm SV; off Slangkop lighthouse, Cape Peninsula, Cape Province.

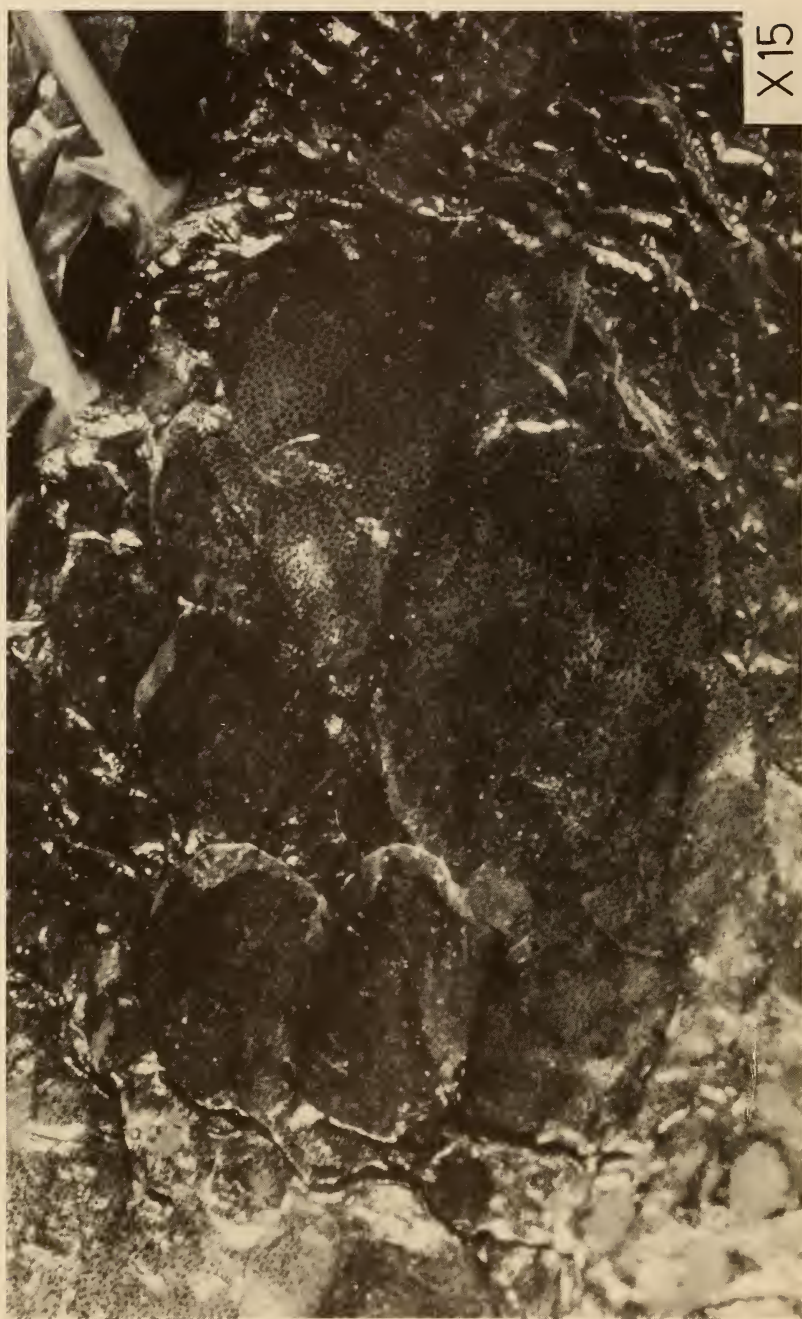
SAM-27679, 248 mm SL, 107 mm SV; 28°23,5'S 32°41,9'E.



Fig. 5. *Zu cristatus* (Bonelli, 1820). Prejuvenile, SAM-27679. Scales on tail.



Fig. 6. *Zu cristatus* (Bonelli, 1820). Prejuvenile, SAM-27679. Scales partially covering bases of lateral line plates.



X15

Fig. 7. *Zu cristatus* (Bonelli, 1820). Prejuvenile, SAM-27679. Shiny patches of very thin scales with pigment attached, situated just behind anus.

Diagnosis

D 120–150; P 10–12; V 5–7 (absent in adults); dorsal caudal fin rays 6–12, set at a steep angle to horizontal axis of caudal peduncle; ventral caudal rays represented by spiny nubbins in adult; prejuveniles with 1–5 ventral caudal rays, with 1 or 2 produced into long filaments. Gill-rakers 2–3 + 8–9. Lateral-line plates 99–106; lateral line begins above middle of eye and continues beyond the vertebral column on to the caudal fin between the second and third ventral caudal rays (about 16 pored scales on the caudal membrane of SAM-27679). Vertebrae: 63–69 total, 22–24 precaudal, 32 pre-anal. SV 41–48 % SL; body depth 20–26 % SL; eye diameter 1,3–1,7 in length of lower jaw, 13–16 % SV. Young silvery, with about 6 wavy dark vertical bars on dorsal part of body and 4 on ventral part; tail with about 6 complete black bars; caudal fin mostly blackish, proximal part pale. Adults silvery grey, paler ventrally; dorsal fin scarlet; caudal fin reddish black, darker distally.

Description of adult (RUSI 13352, 950 mm SL)

D 145; P 11; dorsal caudal fin rays 9; gill-rakers 3 + 8. Body robust (not nearly as compressed as adults of *Trachipterus* or *Zu elongatus* sp. nov.), with fleshy keel along belly; body covered with small, very deciduous, thin, cycloid scales. (All scales on body are missing, but the scale pockets are distinct; a few scales were left on the tail near the lateral line.) Lateral line curving gradually from above opercle to ventral edge of tail 100 mm behind anus; lateral-line scales spiny, represented by two rows of staggered spiny scutes along ventral part of tail. Pelvic fins represented by a few nubbins. Single nostril on each side of snout. Pseudo-branch well developed. Pyloric caeca very numerous. Swim-bladder not apparent.

Measurements for six specimens are given in Table 1.

TABLE 1
Measurements (in mm) of specimens of *Zu cristatus*.

	RUSI 7185	RUSI 7187	RUSI 7188	RUSI 13352	SAM 24522	SAM 27679
Standard length (SL)	205	232	173	950	415	248
Snout to vent (SV)	91	108	76	451	170	107
Greatest body depth	49	56	43	223	84	64
Body depth at anus	19	21	18	123	41	23
Head length	31	—	27	161	60	37
Eye diameter	12	14	10	69	21	14
Maxilla width	6,3	7,3	5,8	32	13	9
Lower jaw length	19	22	16	92	36	23

Remarks

Adults of *Zu cristatus* are apparently rarely captured; only four specimens longer than 800 mm SL have been reported (Bolin 1933; Tortonese 1958; Ibáñez & Gallego 1974; Fitch & Schultz 1978). Judging from the illustration of a 610 mm

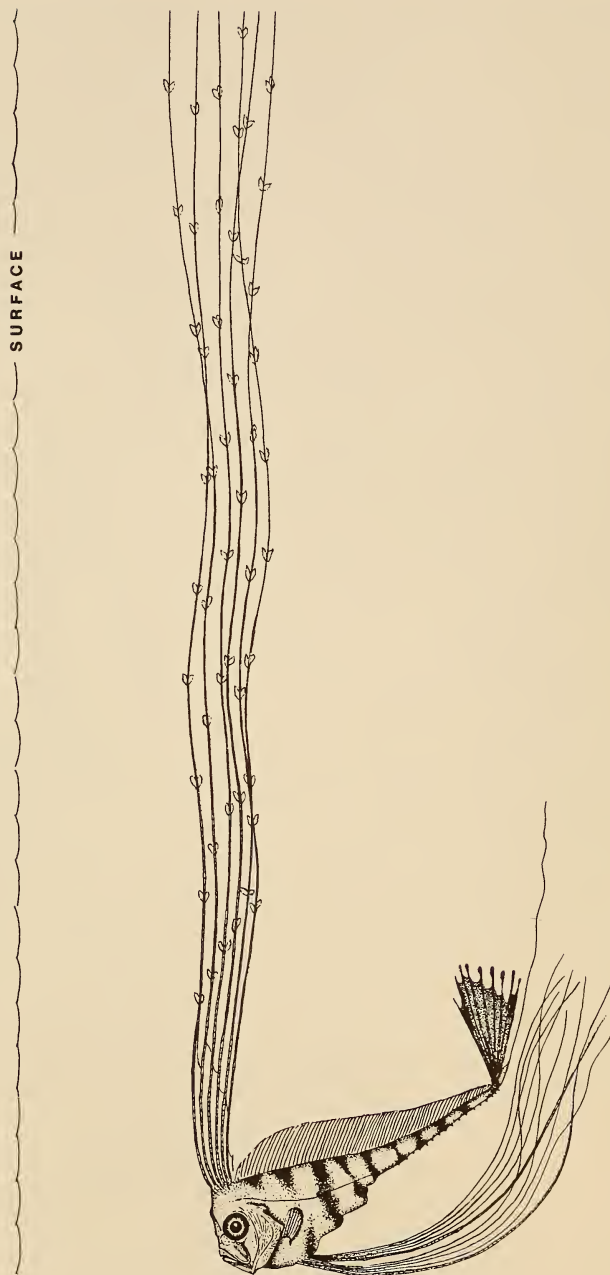


Fig. 8. *Zu cristatus* (Bonelli, 1820). About 100 mm in length. Drawing of a live juvenile swimming in ocean (based on a sketch by Len Jones).

prejuvenile by Tortonese (1970, fig. 190b), metamorphosis takes place in the 600–800 mm size range. The small juveniles that we have examined (64–248 mm SL) are much more compressed than the adults. The pelvic fins and elongated anterior dorsal fin rays are lost during the transition from juvenile to juvenile stage.

Despite previous reports of deciduous cycloid scales on specimens of *Zu cristatus* (Bolin 1933; Tortonese 1958; Walters & Fitch 1960; Palmer 1961; Fitch 1964), Rosenblatt & Butler (1977) discounted these observations, because they could not find scales on their eight specimens (27.5–811 mm SL). As noted above, adults of *Zu* do have scales but the epidermis is very fragile, and there are only a few scales remaining on the tail of the 950 mm SL specimen. On the 248 mm SL juvenile (SAM-27679), the scales are most apparent along the tail (Fig. 5), which they appear to cover completely, and continue on to the caudal fin rays. Some of the bases of the lateral-line plates are partially covered by scales (Fig. 6). The lateral surface of the tail just behind the anus has scales that seem to have pigment attached to them. These scales are apparent on the fish as large shiny patches (Fig. 7). The scales forming these shiny patches are exceedingly thin, but will separate on being lifted with a fine needle. There is evidence of squamation over the entire body area, particularly ventrolaterally where many scaled areas remain intact. The head does not appear to have scales.

Except for the report of Nishimura & Hirotsaka (1964) of a large *Trachipterus* specimen in a relatively small aquarium, there have been no published observations on live trachipterids. In view of the dearth of such reports, the following observations of L. Jones of Fynlands, Natal are of considerable interest. Judging from Jones's sketch, the specimen that he observed was probably *Zu cristatus*.

'I was swimming just beyond the surf-line in 20 feet of water when I noticed what at first appeared to be a small fish caught by a stinging plankton or jellyfish some 6–10 inches below the surface. On closer examination I found it to be a fish with long thread-like fins: . . . a small silvery fish with big head and eye, with red-brown markings, about 3½ inches long. The six [elongated] anterior dorsal rays were at least 15 inches long, with what appeared to be pairs of tiny brown leaf-like appendages set 1½ to 2 inches apart down the length of each dorsal ray. Its pelvics were also very long, about the same length as the body, but I can't remember if the "leaves" were present on these or not. Its tail was all but invisible, but the dorsal fin seemed to be part of its propulsive mechanism (the lower or rear part that is) for it swam in a head-up-tail-down manner which I have drawn for you' (Fig. 8).

Zu elongatus sp. nov.

Figs 9A–11B

? *Trachipterus jacksonensis* (non Ramsay): Hamilton, 1916: 374, fig. 2.

Trachipterus jacksonensis (non Ramsay): Phillipps, 1944: 120, pl. 52. (Unjustified emendation.)

Trachipterus arcticus (non Brünnich): McCann, 1953: 5 (figs 5–6 only).

? *Desmodema arawatae* (non Clarke): Whitley, 1968: 45, fig. 1.

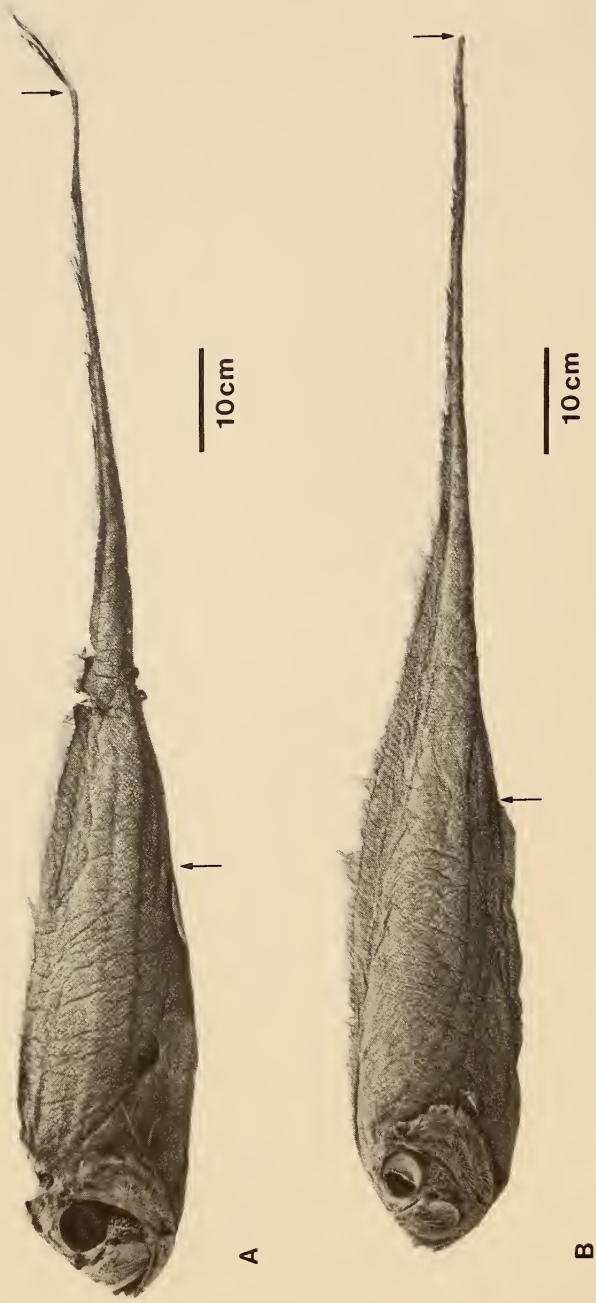


Fig. 9. A. *Zu elongatus* sp. nov. Holotype, adult, SAM-24704, 1 166 mm SL. B. *Zu elongatus* sp. nov. Paratype, adult, SAM-29392, 1 135 mm SL. Arrows indicate position of anus and base of caudal rays.

Holotype

SAM-24704, 1 166 mm SL, 404 mm SV; adult, ?♂. Trawled south-west by west of Cape Columbine, north-western Cape Province; bottom depth 411 m; donated by Captain Jacoby, S. T. *Rochea*; collected 22 November 1965.

Paratypes

SAM-29392, 1 135 mm SL, 421 mm SV; adult, ?♂. Trawled west of Cape Town by Irvin & Johnson Ltd trawler; depth and date of collection unknown.

SAM-19870, 630+ mm SL (part of tail missing), 228 mm SV; juvenile. Trawled north-west of Table Bay by trawler of Irvin & Johnson Ltd; bottom depth 580 m; collected in 1946, exact date unknown.

SAM-24414, 480 mm SL (upper jaw fully protracted), 166 mm SV; prejuvenile. Trawled off Cape Columbine, north-western Cape Province; bottom depth 548 m. Collected and donated by P. Henry, Midwest Fisheries Ltd, Cape Town, 1 February 1965.

Other material

SAM-29396, 1 123 mm SL, 421 mm SV; adult, badly damaged; no data.

NMNZ P.834, c. 425 mm SL, 138 mm SV; French Pass, New Zealand.

NMNZ P.2248, 315 mm SL, 108 mm SV; Awanui, New Zealand.

Diagnosis

D 142-147; P 11-12; V 7, elongate in young, absent in adults; C 17 (12 dorsal rays and 5 ventral rays of which 2 may be represented by tiny spines). Gill-rakers 2-3+7-9. Lateral-line plates 127-130. Vertebrae: 84-87 total, 29-31 precaudal, 38-40 pre-anal. SV 34-37% SL; body depth 12-16% SL; eye 9-10% SV. Teeth: 9-21 in upper jaw, 6-9 in lower jaw; adults with 2 vomerine teeth; palatine teeth present or absent. Dermal tubercles and pore system present at all stages; scale pockets well developed in adults (Fig. 10).

Description (measurements in Table 2)

Adult (holotype, 1 166 mm SL; Fig. 9A)

Body laterally compressed, tapering gradually to the elongate tail; dorsal body profile convex, the ventral profile irregular; fleshy keel along ventral midline of belly. Body, tail, and cheeks covered with tubercles and conspicuous pores; scale pockets distinct; tubercles on cheek enlarged.

D 143, the posterior rays long, filamentous; P 11; pelvic fins absent, represented by bony ridge within a slit-like pocket; 2 of the 5 ventral caudal fin rays are small rudimentary spines; the other caudal rays elongate, the longest 160 mm. Gill-rakers 3+8; lateral-line plates c. 128. Teeth: upper jaw with 10 on right side of symphysis, 11 on left side; lower jaw with 6 teeth on right side of symphysis and 3 on left side; 2 teeth on vomer, 3 teeth on right palatine, 2 teeth on left palatine.

Colour in alcohol: body tan, interspersed with paler tubercles; front of head with triangular dark area, extending on to lips and gular region; posterior dorsal fin rays black; caudal fin black except for a small, pale area proximally.

Prejuvenile (480 mm SL; Fig. 11A)

Body elongate, laterally compressed, gradually tapering to caudal fin, not abruptly constricted behind vent; dorsal profile of body convex; ventral profile anterior to anus strongly scalloped, with three well-defined ventral lobes. The strong upward curve of the tail, characteristic of juveniles in *Zu cristatus*, is not apparent in this specimen. Lateral line curving gradually from above opercle to ventral margin of tail 30 mm behind anus. Body surface abraded; no scales or scale pockets apparent.

D 147, the first 6 rays elongate; P 11; pelvic fins elongate; caudal directed upward, the rays elongate (longest 170 mm). Gill-rakers 3 + 8–9; lateral-line plates *c.* 127. Teeth: upper jaw with 8 on right side of symphysis, 10 on left side; 4 on each side of lower jaw symphysis; no teeth on palatines or vomer.

Colour in alcohol: three incomplete dark cross-bars on body; five dark bars on tail. Triangular dark area above and extending across symphysis of upper jaw; dusky area across lower jaw symphysis, extending on to gular region. Distal part of caudal fin dark; some dorsal fin rays with traces of dark pigment.

Juvenile (630+ mm SL; Fig. 11B)

Body shape as for juvenile; ventral lobes smaller and less distinct. Caudal fin missing; anterior dorsal rays and pelvic fins elongate. Dermal tubercles on cheek enlarged; scale pockets visible at 40 × magnification.

D 137; P 12; gill-rakers 2–3 + 7; lateral-line plates *c.* 130. Teeth: upper jaw with 7 on right side of symphysis, 4 on left side; lower jaw with 2 teeth on right side and 4 on left; 2 teeth on vomer and 1 on right palatine.

Colour in alcohol: six dark cross-bars on tail; symphysis of lower jaw dark. Body abraded, with no other pigmented areas apparent.

Paratype SAM-29392, 1 135 mm SL (Fig. 9B), differs from the holotype SAM-24704, 1 166 mm SL and from the other adult, SAM-29396, 1 123 mm SL, in that it lacks palatine teeth. SAM-29396 has only 9 teeth in the upper jaw. However, the teeth in *Zu elongatus* are easily detached and since SAM-29396 is a badly damaged specimen some teeth might have been lost.

Remarks

As denoted by the name, *Zu elongatus* is more elongate than *Zu cristatus* (body depth 12–16 % SL, versus 20–26 % SL). Other differences between these two specimens are the size of the eye (9–10 % SV in *Zu elongatus*, 13–16 % SV in *Zu cristatus*), number of the lateral-line plates (126–130 in *Zu elongatus*, 99–106 in South African specimens of *Zu cristatus*, but 114–118 reported by Fitch (1964) for eastern Pacific material), and vertebral counts (84–87 total, 29–31 precaudal, 38–40 pre-anal for *Zu elongatus*; 63–69 total, 22–24 precaudal, 32 pre-anal for *Zu cristatus*). Palmer (1961) and Fitch (1964) give counts of 64–65 and 63 for total vertebrae of *Zu cristatus* from the eastern Atlantic and eastern Pacific. The ranges of vertebral counts for South African specimens given above are from 6 specimens of *Zu cristatus* and 5 of *Zu elongatus*.

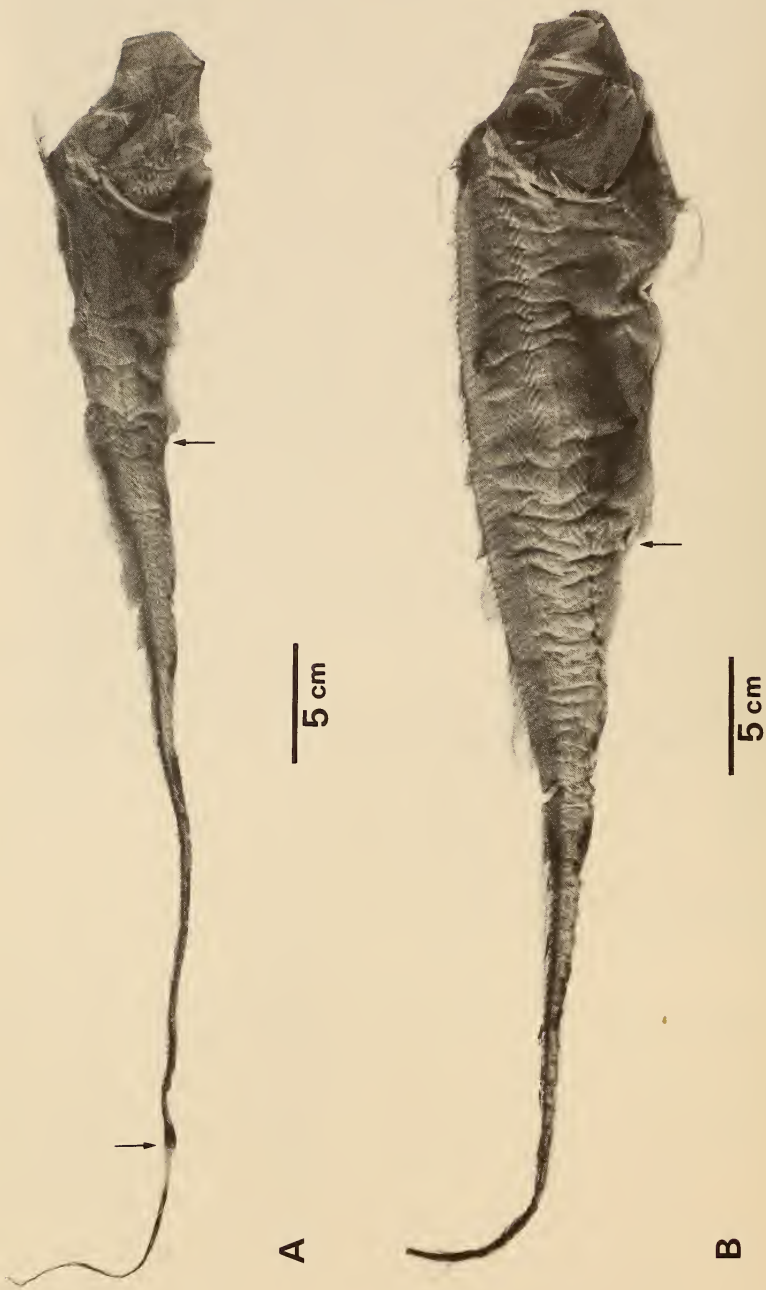


Fig. 11. A. *Zu elongatus* sp. nov. Paratype, prejuvenile, SAM-24414, 480 mm SL. B. *Zu elongatus* sp. nov. Paratype, juvenile, SAM-19870, 630+ mm SL. Arrows indicate position of anus and base of caudal rays.

Fitch (1964) recognized *Trachipterus semiophorus* Bleeker (described from Indonesia) and *T. ijimae* Jordan & Snyder (from Japan) as synonyms of *Zu cristatus*. All the other synonyms of *Zu cristatus* are based on specimens from the Mediterranean Sea, and all the recognizable published descriptions and illustrations of *Zu* from the Mediterranean are of *Zu cristatus*. It seems, therefore, that *Zu elongatus* does not occur in the Mediterranean Sea.

The specimen described and figured by Whitley (1968: 45, fig. 1, as '*Desmodema arawatae*') is the same one reported by Hamilton (1916) from Nelson, South Island, New Zealand as '*Trachipterus jacksonensis* Ramsay?'. This fish appears to be *Zu elongatus*. The measurements given by Whitley (1968: 45), as well as his figure, show the body depth to be 16 per cent of the standard length (which is within the range for *Zu elongatus*, but not for *Zu cristatus*). We have examined the specimen from French Pass, Cook Strait, reported (as *Trachipterus jacksoniensis*) by Phillipps (1944) and (as *Trachipterus arcticus*) by McCann (1953). Data from this specimen (NMNZ P.834) plus one other from New Zealand (NMNZ P.2248) are not included in the diagnosis or description of *Zu elongatus* given above. Counts and measurements from this New Zealand material are as follows (P.834 given first): SL c. 425 (tip of tail separated from rest of specimen), 315; SV 138, 108; greatest body depth 66, 48; body depth at anus 34, 22; head length 53, 43; eye diameter 15, 14; lower jaw length 31, 25. Lateral-line scales 125, 131; pectoral-fin rays 12, 12; dorsal-fin rays, damaged, 6+132; total vertebrae c. 88, 88; pre-anal vertebrae 39, 37; and precaudal vertebrae 32, 30.

Family Radiicephalidae

Diagnosis

Body elongate, strongly compressed, the depth decreasing gradually from just behind head to last vertebra. Dorsal fin origin over eye. Anus well before midpoint of body. Anal fin rudimentary, located about half-way between anus and last vertebra. Pelvic fins rudimentary in adults, with 6–9(?) rays in juveniles. Lateral line continued beyond last vertebra where the canals of either side are joined to form a large, thin-walled tube carried on the greatly elongated 'rays' that emanate from the ventral surface of the last three vertebrae. Length of posterior vertebrae less than twice that of tenth vertebra. Upper jaw highly protrusile. Skin with scattered soft papillae and numerous pores. Swim-bladder well developed; ribs and ink-sac present.

Radiicephalus elongatus Osório, 1917

Radiicephalus elongatus Osório, 1917: 114, figs 2–4. Walters, 1963: 456. Harrison & Palmer, 1968: 185, figs 1–6. Palmer, 1973: 333. Parin *et al.*, 1974: 116, fig. 13. Karrer, 1976: 179, pl. 1, text-fig. 1. Parin, 1978: 163. Parin *et al.*, 1978: 176.

Material

SAM-29416, c. 310 mm SL (upper jaw protracted), 420 mm TL; 70 miles south-west of Cape Point; 600 m; Engels midwater trawl; collected by the South African Sea Fisheries Institute, 24 May 1982.

Description (measurements in mm)

Body and tail elongate, strongly compressed. SL c. 310; body depth at pectoral fin base 32, at anus 24,3, and at anal fin origin 11,0; body width at pectoral base 7,5; SV c. 124; snout to anal fin c. 188; pelvic fins to vertical at rear end of pectoral base 20,5; from pelvic fins to anus 44, from anus to anal fin 67; head length c. 51; orbit diameter c. 13; interorbital width 8; lower jaw length 26; maxilla width 10,3.

Dorsal fin with 160 rays, the origin above the eyes, the last ray over the twenty-sixth preural centrum; pectoral fin rays 10 (including the short, spine-like first ray), the longest ray 10 mm; pelvic fins damaged, most of the rays broken off at their bases, which number 6 or 7; one 47 mm ray is still attached to the pelvic fin base; anal fin rays 6, the longest ray 3 mm; length of anal fin base 3 mm. Gill-rakers 3 + 8, the upper rudimentary, the anteriormost very short; branchiostegal rays 4 + 3 (left side with 4 + 2 rays, but the membrane is torn and one ray has probably been lost).

Lateral line begins over eye and drops to 6 mm above the anus, thence running close to the ventral edge of the tail (1 mm above anal fin base). No individual lateral-line scales apparent; the canal comprises a large, thin-walled (almost transparent) tube; at about the anal fin the tube runs along the ventral edge of the vertebral column on a shelf formed by the elongate slender haemal spines (haemal spine of eighteenth preural vertebra 12,4 mm long; centrum length 2,8 mm); posterior to the end of the vertebral column, the lateral-line tubes are carried between the dorsal and ventral caudal fin 'rays', which are 108 mm long; width of lateral-line tube at penultimate vertebra 1,0 mm and the vertical height of this centrum is 0,6 mm.

Total vertebrae 121, precaudal vertebrae 38, pre-anal 45; ribs are present on all precaudal vertebrae except the first three. Length of tenth centrum (2,2 mm) equals height of centrum at its posterior end; length of tenth preural centrum (3,2 mm) equals 4,5 times height of centrum at its posterior end.

Upper jaw with a patch of small sharp teeth plus one much larger retrorse tooth at each side of premaxillary symphysis; a series of 7–9 slender sharp teeth on each side of lower jaw symphysis; 3 slender sharp teeth on vomer and 2 or 3 similar teeth on each palatine.

Body and tail silvery in life; dorsal fin base blackish.

Remarks

The specimen described above agrees well with the 597 mm SL neotype described by Harrisson & Palmer (1968) and the 520 mm SL specimen described by Karrer (1976). The lack of countable lateral-line scales in the SAM fish may be due to the abrasion that the specimen has suffered and/or its smaller size. The difference in the number of branchiostegal rays reported by the previous authors (6 versus 7 on the right side of the SAM fish) may reflect damage to their specimens, or perhaps the fact that the anterior two rays on the epihyal are close together and might have been counted as a single ray.

The exact nature of the caudal fin 'rays' is not clear; the ventral group of two or three 'rays' seems to comprise the greatly elongated haemal spines of the last two or three preural centra. The rays above and below the lateral-line tubes are longitudinally striate, but none of these rays is segmented.

The specimen described above represents the first record of this species for the south-eastern Atlantic Ocean. *Radiicephalus elongatus* is known from the Atlantic and Pacific oceans and may also occur in the Indian Ocean.

ACKNOWLEDGEMENTS

We are indebted to Mr Alwyne Wheeler and the British Museum (Natural History) for supplying radiographs of *Trachipterus trachipterus* and copies of rare publications. Mr Wheeler also reviewed the manuscript and offered advice on the validity of *Trachipterus trachipterus* (Gmelin, 1789). Dr Richard H. Rosenblatt of the Scripps Institute of Oceanography kindly lent a specimen of *Desmodema polystictum*. A radiograph of *D. polystictum* was supplied by the Fish Division of the US National Museum of Natural History. We thank Dr Douglas Hoesse and the Australian Museum for data and a radiograph of the holotype of *T. jacksonensis*. We are grateful to Dr Graham Hardy of the National Museum of New Zealand for the loan of specimens from New Zealand. Mr Jean-Michel Vinson did the drawings (Figs 2 and 8). Mr Len Jones contributed his observations of a live specimen of *Zu.* Prof. M. N. Bruton, Miss A. E. Louw and Dr P. A. Hulley offered constructive comment on the manuscript. Mr R. E. Stobbs produced several excellent radiographs.

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